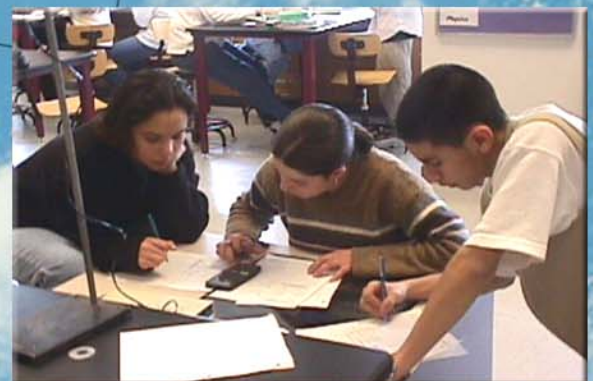


The National Science Education Acts of 2000

A plan to renew science, mathematics, engineering, and technology education in kindergarten through 12th grade.



Congressman Vernon J. Ehlers
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Congress of the United States of America
House of Representatives

Vernon J. Ehlers

Michigan

Improve Science Education
Support K-12 Science, Math, Engineering & Technology Education Reform

April 20, 2000

Dear Colleague,

As outlined in *Unlocking Our Future: Towards A New National Science Policy*, the science policy report adopted by the House on September 24th, 1998, our science and technology enterprise has the ultimate goal of improving the lives, health, and freedom of all peoples. Our country's scientific strength is at the heart of our recent economic boom and undergirds our national defense. In so many ways, America depends on science.

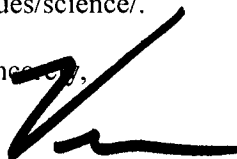
However, a preponderance of evidence indicates that our schools aren't preparing our students adequately for the knowledge-based, technologically rich America of today and tomorrow. Without a strong supply of scientists, engineers, technologically competent workers, and scientifically literate consumers and voters, the future well being of America is in jeopardy.

I am offering three bills to address this situation.

- H.R. 4271, the **National Science Education Act**, which, among other things, directs the National Science Foundation to set up a program of master K-8 elementary teachers to mentor and train their peers in hands-on, inquiry-oriented, concept-based instruction. This bill also establishes a working group of scientists and educators to investigate the ideal scope, sequence, and content of curricula in our country.
- H.R. 4272, the **National Science Education Enhancement Act**, which, among other things, sets up meaningful professional development for science and math teachers through rigorous summer institutes.
- H.R. 4273, the **National Science Education Incentive Act**, which, among other things, provides tax credits to beginning science and math teachers with strong content preparation and tax incentives to businesses who provide assistance to local schools to help with science, mathematics, engineering and technology training.

If you would like to sign on as a cosponsor or would like more information about these bills, please contact Michael Lach or Jodi DeWitte in my office at x5-3831. Additional information is also available on my web-site at: www.house.gov/ehlers/issues/science/.

Sincerely,


Vernon J. Ehlers
Member of Congress



The National Science Education Acts of 2000

A plan to renew science, mathematics, engineering, and technology education in kindergarten through 12th grade.

H. R. 4271: The National Science Education Act

H. R. 4272: The National Science Education Enhancement Act

H. R. 4273: The National Science Education Incentives Act

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<http://www.house.gov/ehlers/issues/science/>

Introduction

Our science and technology enterprise has the ultimate goal of improving the lives, health, and freedom of all peoples. Our country's scientific strength is at the heart of our recent economic boom and undergirds our national defense. America depends on science.

However, a preponderance of evidence indicates that our schools aren't preparing our students adequately for the knowledge-based, technologically rich America of today and tomorrow. Without a strong supply of scientists and engineers, of technologically competent workers, and of scientifically literate consumers and voters, the future well being of America is in jeopardy.

American student performance in math and science is not on par with students in other countries. Recent assessments of the progress of student performance in various subject areas, including Science, Math, Engineering, and Technology education, have concluded that in some age groups the grasp of science and math by U.S. students is less than that of their international peers. These findings prove that our twelfth grade students are far from the goals set by the Bush Administration and 50 State Governors of being first in the world in math and science by the year 2000.

It also is notable that over half of our graduate students in science and engineering are foreign-born. The attraction of these students to American Ph.D. and post-doctoral level programs highlights a situation with serious long-term implications for the U.S. The apparent lack of interest or preparation many of our own students seem to have for careers in science or engineering will limit the innovation that propels the economic growth that creates prosperity. Indeed, some of the blame for this situation can be placed on a K-12 educational system that does not sufficiently excite or educate students in math or science and discourages further pursuit of these subject areas.

The short-term ramifications of inadequate preparation and lack of interest in science, math, engineering and technology are already visible. There are hundreds of thousands of technology-related jobs that are unfilled in the U.S.—despite an average salary (in 1996) of \$46,000, more than fifty percent more than the average wage of \$28,000 (U.S. Department of Commerce). In 1999 American companies, unable to continue without an adequate domestic pool of potential employees, implored upon Congress to increase the statutory cap on the number of visas for foreign, skilled workers. Congress responded by raising the limit for three years. This action, however, is not meeting industry's need: the cap for 2000 was already reached in March 2000.

In order to reverse this trend of the U.S. economy outpacing the supply and qualifications of domestic skilled workers, we must continue to nurture all citizens so they may develop a solid educational foundation. We must be able to broadly train people so that American companies can fill the needed positions with qualified and capable U.S. citizens. If we hope to remain the world's leading economy, we must be able to continue to rely upon a talented and versatile workforce.

Moreover, cutting-edge skills are no longer required only of scientists, mathematicians, engineers and the like. There is a "real world" impetus for learning science and mathematics. Many of today's jobs require more than a basic level of technical competence. It is well known that many of the higher paid entry-level jobs are in the computer and related technology fields. But in addition to the ever-increasing demand for jobs that require specialized knowledge, virtually every job now demands some level of technical competence and problem solving skills. For

example, in the past typing, basic math and an understanding of measurements were sufficient skills to work in offices, retail stores, and factories, respectively. These same positions now require word processing and spreadsheet manipulation, general computer skills, and mastery of complex machinery, which, again, is often computer-controlled. For many Americans, these skills are no longer part of “on-the-job training,” but rather prerequisites for entry-level positions.

It also is clear that the long-term implications still are to come. Over half of our economic growth today can be attributed directly to research and development in science and technology. Notably, the technological sector of our economy, which is driving our current economic boom, was fueled by scientific discoveries. Our ability to maintain this economic growth will be determined largely by our Nation’s intellectual capital. The only necessary and sufficient means to developing this resource is education.

In addition to ensuring the conditions for economic prosperity, quality science, math, engineering and technology education increasingly is becoming necessary for day-to-day life. For citizens to thrive in 21st Century America, a well-rounded and deep literacy in scientific ideas and processes will be essential. Our society is now based upon technology and information, and in this new century the most valuable commodity is knowledge. As communications technologies rapidly change the way in which we interact with one another, the key to success is no longer acquiring information but rather analyzing and processing that information. To be wise consumers, intelligent voters, and coveted employees our citizens will need to know the skills of science—collecting data, evaluating evidence, finding trends, designing experiments—more than ever. The demand for quality science and math education is increasing.

Context for Solutions

We have much to be proud of in our Nation’s educational systems, but we always ought to be seeking to address our weaknesses and to improve our performance.

In the context laid out above, education programs must provide unsurpassed science, math, engineering and technology instruction to every K-12 student. New methods of teaching math and science should be integrated into curricula. Science and math lessons should include more than just memorizing a collection of facts, theories, and results. Science classes should focus on a process of inquiry built upon observations and data that lead to a way of knowing and explaining in logically derived concepts and theories. Students should learn science primarily by doing science; the lessons ought to reflect the scientific process, be object-oriented, experiment-centered, and concept-based. Auspiciously, pedagogical techniques that take advantage of this model can tap into children’s curious and inquisitive nature and develop an excitement for these subjects.

To ensure that students are provided the best possible learning environment, studies are revealing that the most important factor of educational improvement efforts, especially those in science, math, engineering and technology, is enthusiastic and well-prepared teachers. When integrating the needs of learners into the context of the emerging needs of the American workplace and society, the truth of the observation “teaching is the essential profession, the one that makes all other professions possible” is obvious.

Teachers provide the essential connection between students and the content they are learning. Thus, high quality teachers must be identified, recruited, and retained in every school

district throughout the Nation. K-12 science, mathematics, engineering or technology teachers should be respected by their peers, rewarded financially and intellectually, and have sufficient opportunities for advancement. In exchange, we must expect that all teachers are knowledgeable of their content area, curriculum, up-to-date research in teaching and learning, and techniques that can be used to connect information to the students in their classrooms. Therefore, teachers, just like other professionals, should be offered incentives to remain in the classroom and improve their practice.

However, most school administrators, government education officers, and parents now acknowledge that the causes of mediocrity (and in some cases failure) in our school systems are not the result of a single flaw. Many educational practices, such as teaching methods, teacher training, school organization, and administration processes, are interconnected. Thus, reform efforts must be broad-based and comprehensive.

K-12 education in the United States is primarily the charge of local and State governments. The Federal Government plays a role in certain efforts, especially as an impetus to change. Most State reform initiatives begun in the past several years have adopted the strategy of improving all aspects of educational systems and do take advantage of federal incentives toward change in particular directions. Thus, although State efforts are tailored to meet the needs and preferences of the individual locality, there are threads of commonality inspired by federal actions.

Among the States, the successful reform efforts all involve multiple stakeholders including governments, school administrators, teachers, community members and parents. There is an expectation of responsibility among these partners and of the students that is unprecedented. And such accountability appears to be working.

From these local demonstrations of success, what role should the Federal Government play in encouraging such progress? In furthering the principle of a solid commitment to high student academic achievement the Federal Government can serve as a resource to State and local governments without superseding local efforts. However, all partners to education reform must incorporate the dual tenets of quality teaching and state-of-the-art educational programs into education reform, especially in the core areas of science, math, engineering and technology, as mastery of these disciplines will continue to propel the economy and better the lives of all individuals.

Summary of Prominent Issues and Proposed Actions

H. R. 4271: The National Science Education Act

The National Science Education Act (NSEA) is the centerpiece of the National Science Education Acts of 2000 package. NSEA focuses on improving and expanding the activities of the National Science Foundation.

Assisting Teachers

Issue: Teachers often work independently in developing lesson plans, seeking out new pedagogical techniques and maintaining the equipment and materials in their classrooms. Due to competing time commitments and limited school resources, teachers frequently are not given adequate support in these activities.

NSEA: Provides grants to public and private schools for the hiring of Master Teachers with strong backgrounds in math, science, and pedagogy. Master Teachers will provide K-8 teachers assistance with professional development and support for the use of hands-on science materials.

Issue: With the rapid introduction of computers and other technology into educational programs, many teachers have not had the opportunity to receive the training they need to make the most effective use of the new tools and materials.

NSEA: Specifies that NSF award grants for teacher professional development in technology use and integration.

Issue: K-12 science, math, engineering and technology teachers often are not considered “scientists,” “mathematicians,” etc. by their subject-matter peers. These teachers also rarely have the opportunity for practical participation in research or for the continuing education that accompanies direct involvement in an area of expertise.

NSEA: Creates a national scholarship to reward teacher participation in science, math, engineering or technology research.

Issue: Some prospective teachers are prevented from pursuing math or science teaching careers because they were not aware of and did not take specified high school courses prerequisite to teacher training college courses.

NSEA: Establishes a mechanism to inform high school students of the high school courses they should complete to prepare for the courses they will need in college for a career as a science, math, engineering or technology teacher.

Improving Education for All Students

Issue: School administrators often select educational programs without having the benefit of evaluations or a sufficiently comprehensive awareness of the offerings needed to choose the best possible programs.

NSEA: Creates a working group to identify excellence in content, scope, and sequence in supplemental K-12 science, math, engineering and technology educational programs across the Nation and make that information available to all teachers via the Internet.

Issue: The quest to modernize classrooms has led to technology being used in diverse ways. Some of these uses strengthen current educational practice and some supersede proven methods. There is a lack of consensus regarding the most effective uses of technology in the classroom.

NSEA: Requires a study to evaluate the uses of technology in the classroom.

Issue: Teachers have limited access to information regarding the newest high-quality science, math, engineering and technology educational programs.

NSEA: Increases teachers' access to cutting-edge education programs by requiring NSF-sponsored programs to be posted on the NSF Internet web site.

Issue: Students may not be taught the skills needed to become technologically literate because their teachers also lack a solid technology foundation.

NSEA: Provides access to training for middle school teachers so that all students are technologically literate by the time they enter high school.

Issue: Students in rural schools do not always receive the same learning opportunities, such as access to museums and laboratories, as students in more densely populated areas.

NSEA: Bolsters rural educational opportunities by supporting distance learning components of science, math, technology and engineering grants funded by NSF.

Issue: With the rapid inclusion of technology into educational materials, there is a need for more and better educational software. Students themselves should be rewarded for creativity that integrates their newly learned skills.

NSEA: Creates a competition for high school and college students to develop educational software.

- Issue: Students who attend the Nation's poorest schools often have limited opportunities to learn using the most modern Information Technology equipment, and also cannot afford the higher education necessary for many careers in I.T.
- NSEA: Establishes a pilot program for setting up private sector contributions to and involvement with the information technology programs in the neediest high schools.
- Issue: Private sector participants in education do not have access to a mechanism that assists them in avoiding duplication, in learning of each others' successes and in cooperating.
- NSEA: Calls for a NSF conference to link members of the private sector involved in science, math, engineering and technology education.

H. R. 4272: The National Science Education Enhancement Act

The National Science Education Enhancement Act (NSEEA) concentrates on improving and expanding the activities of the Department of Education that focus on science, math, engineering and technology education.

Assisting Teachers

- Issue: Novice teachers often are not provided any support in adjusting to a teaching career. Many first, second and third year teachers leave the teaching profession because of this inadequate support. Furthermore, science, math, engineering and technology teachers are more likely to leave the profession because there is a lucrative job market for individuals with expertise in these areas.
- NSEEA: Provides mentors for novice teachers to reinforce the induction process.
- Issue: Professional development available to teachers commonly is not comprehensive, long-term, content-based, focused on subject matter and tied to school-year curricula.
- NSEEA: Authorizes peer-reviewed quality summer professional development institutes.
- Issue: Facing the challenge to upgrade technology in every classroom while having limited resources, school administrators often are forced to choose between purchasing hardware and software for students or providing instructional materials and training for teachers. Teachers often find themselves with new educational technology, but without the training necessary to ensure its effectiveness.
- NSEEA: Upgrades the capabilities of teachers by providing them needed technology training and instructional materials.

- Issue: All teachers have not yet become technologically literate.
- NSEEA: College students with expertise in technology can use these skills to train or tutor K-12 teachers in exchange for Work-Study credit.

Improving Education for All Students

- Issue: Teachers seeking to supplement their science curricula with other materials are faced with a plethora of excellent materials but lack sufficient time or resources to search, evaluate, and choose the appropriate units.
- NSEIA: Expands teacher access to quality math, science, engineering and technology programs by enhancing the Eisenhower National Clearinghouse to include program evaluations. The Clearinghouse will also be improved with the addition of a web-based, internal search engine to link each program with sites offering classroom and lecture demonstrations, teachers who have used the program, materials, vendors, curricula and textbooks. Finally, the Clearinghouse will be required to maintain a comprehensive database of all programs.
- Issue: Many of the after-school programs funded by the Federal Government do not have an academic component and do not provide children with an opportunity to discover or learn.
- NSEIA: Widens children's opportunities to experience science first-hand by creating after-school science day care programs.

H. R. 4273: The National Science Education Incentive Act

The National Science Education Incentive Act (NSEIA) concentrates on expanding provisions in the tax code to encourage activities that will benefit science, math, engineering and technology education.

Assisting Teachers

- Issue: Prospective K-12 science, math, engineering and technology teachers are deterred from entering the teaching profession by the prospect of large school loans and a low salary.
- NSEIA: Eases the financial burden for teachers by providing a tax credit of ten percent of their total college tuition, up to \$1,000 per year for 10 years, for K-12 science, math, engineering and technology teachers who graduated from rigorous, content-based preparation programs.

Issue: Science, math, engineering and technology teachers rarely have the opportunity to participate in their fields of scientific or mathematical expertise.

NSEIA: Affords teachers with learning opportunities and practical experience through Externships.

Issue: Many private sector companies hold regular training workshops and classes for their employees, many of which would also be beneficial to teachers.

NSEIA: Augments availability of practical professional development for teachers through access to workforce training by providing a tax credit to private sector companies for including teachers in these trainings.

Improving Education for All Students

Issue: Private sector school, technology and laboratory supply businesses have no incentive to make donations of needed equipment to schools.

NSEIA: Spurs private sector contributions of science, math, engineering and technology equipment by providing a tax credit.

Issue: Private sector companies have expertise in workforce training but do not have an incentive to donate their services to K-12 students.

NSEIA: Enlarges students' access to workforce training by providing a tax credit to the private sector for contributing instruction to science and math students in grades K-12.

Talking Points

H. R. 4271: National Science Education Act

- Provides funds for Master Teachers who, through professional development and support for utilization of hands-on inquiry materials, will lead groups of science, math, engineering or technology teachers in grades K-8.
- Improves educational technology by creating a competition for high school and college students to develop educational software.
- Identifies the best K-12 science, math, engineering and technology educational programs across the Nation.
- Encourages private sector contributions to and involvement with the information technology programs in the neediest high schools.
- Assists high school students in the pursuit of careers as science, math, engineering or technology teachers by informing them of the high school courses they should complete to prepare for the courses they will need in college.
- Strengthens the use of technology in the classroom by investigating what techniques and methods are most effective.
- Supports teachers with a program for professional development in technology use and integration.
- Empowers middle school students to become technology-literate by ensuring that their teachers are provided the necessary training.
- Promotes private sector involvement in science, math, engineering and technology education by linking participants with each other and distributing best practices.
- Bolsters rural educational opportunities by encouraging distance learning components to science, math, technology and engineering education programs.
- Increases teachers' access to cutting-edge education programs by posting NSF-sponsored programs on the NSF Internet web site.
- Rewards teacher participation in science, math, engineering or technology research.

H. R. 4272: National Science Education Enhancement Act

- Reinforces the induction process by providing mentors to novice teachers.
- Expands teacher access to quality math, science, engineering and technology programs by improving the Eisenhower National Clearinghouse.
- Supports teachers through quality summer professional development programs.
- Upgrades the capabilities of teachers by providing needed technology training instructional materials.
- Widens children's opportunities to experience science first-hand by creating after-school science day care programs.
- Benefits college students by allowing Work-Study credit for training or tutoring K-12 teachers to use technology in the classroom.

H. R. 4273: National Science Education Incentive Act

- Eases the financial burden for new science, math, engineering and technology K-12 teachers by providing a tax credit to help pay off student loans.
- Spurs private sector contributions of science, math, engineering and technology equipment.
- Enlarges students' access to workforce training by encouraging the private sector to provide instruction in grades K-12.
- Affords teachers learning opportunities and practical experience through Externships.
- Augments availability of practical professional development for teachers with access to workforce training.